

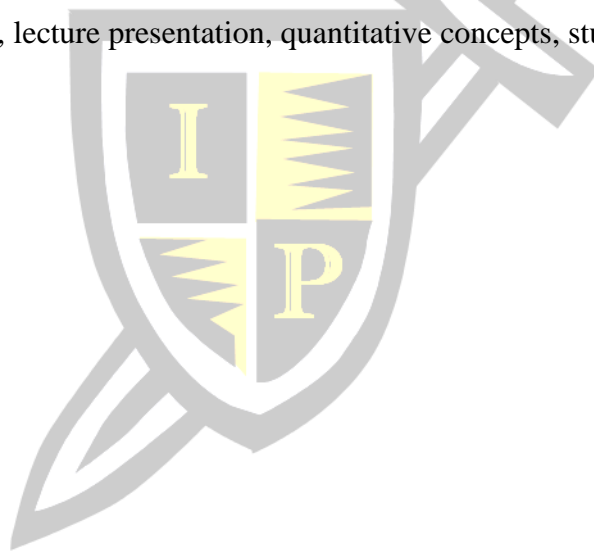
## **Student performance predictors involving numerically based subject matter: Lecture versus web presentation**

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### **ABSTRACT**

This study examines whether student performance predictors in a numerically based lecture course are similar to those for the web version of the same course. A numerically based course involves quantitative concepts and requires mathematical calculations. Data were collected from students taking a financial management class at a medium sized state university. Students had the option upon registration to choose the lecture presentation or the web-based version of the course. Examination of the significant variables presents only one common predictor of student performance – semester GPA prior to enrolling in the course. Otherwise, different predictors are significant, dependent upon the method of presentation. Furthermore, students in the lecture class performed better than those enrolled in the web version.

Keywords: web courses, lecture presentation, quantitative concepts, student performance



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## INTRODUCTION

Mathematical courses often prove challenging for many college students. Math instructors are embracing technology as a method to increase understanding (Boster et al, 2006), while many students prefer the traditional classroom setting with an instructor (Johnson et al, 2009). Many studies have found no difference in the success of online students versus those enrolled in the lecture version of the same class (Russell, 1999; Gange and Shephard, 2001; Neuhauser, 2002; and Reuter, 2009). However, few, if any, have tried to examine whether the predictors of student performance were the same for a mathematically oriented course, regardless of the method of presentation.

Therefore, this study examines whether performance predictors for students in a numerically based lecture course are similar to those for the web version of the same course, as well as, to determine if there is a difference in the performance of such students. A numerically based course involves quantitative concepts and requires mathematical calculations. Data were collected from students enrolled in a financial management class at a medium sized state university. Students had the option upon registration to choose the lecture presentation or the web version.

## COURSE SURVEYED

The financial management course surveyed is delivered every semester via the traditional lecture format, but is offered as a web-based class in the summer only. Students had the option upon registration for the summer sessions, 2007-2012, to choose the lecture presentation or the online version. Over the six year period, 176 total students signed up for the lecture version of financial management; 128 total students registered for the web class. The textbook (various editions) remained the same, as well as, the methods to assess student performance: chapter quizzes, chapter homework assignments, periodic exams, and a comprehensive final exam. While the course was staffed by three terminally degreed professors, the material covered was identical and included the following topics: time value of money, financial statement analysis, bond and stock valuation, cash flow estimation, risk and return, cost of capital, and working capital management.

Students seeking a baccalaureate degree from the university's college of business must earn a "C" or above in financial management in order to graduate (the class is rarely taken by someone outside of the college.) Because of its mathematical content, financial management is considered by some students to be particularly challenging. There are numerous prerequisites for this course; these include managerial or financial accounting; micro and macroeconomics; statistics; and completion of 54 hours of non-developmental coursework.

### Lecture presentation

In the lecture presentation, students attended a two and one-half hour class held on the university campus, Monday through Thursday, for four weeks. Professors lectured and worked problems for those enrolled. Students were encouraged to ask questions and participate in class discussions. Power point slides, as well as, answers to assignments were made available to students. Outside of class, faculty held office hours (10 hours per week); students could also contact faculty via email and discussion forums. The course was not self-paced: certain chapters

were covered at prescribed upon times; assignments and quizzes had specific due dates. Closed book, paper and pencil exams were administered on the dates specified in the syllabus.

### **Web presentation**

All work for the course was delivered over the internet. The Blackboard course management system was utilized until the university discontinued its license. Later, Aplia for Finance, was adopted. The online course was deployed over an 8 week period. Communication between students and faculty occurred via the course management system, as well as, email and discussion forums. As in the lecture presentation, power point slides and answers to assignments were made available to students. The course was not self-paced: online assignments and quizzes had specific due dates, and were to be completed in a certain order. Exams, including the final exam, were made available online and had to be completed on a specific date.

### **HYPOTHESIS 1**

The following relationship is hypothesized: performance predictors for students in a numerically based lecture course are not different than the performance predictors for students in the web version of the same numerically based course. The numerically based course surveyed is financial management; successful completion of which is required for those seeking a baccalaureate degree in business. Success in the course is defined as having earned an A, B, or C, while failure is defined as D, F, or W; students receiving a D, F or W, will have to take the class again. The student performance predictors investigated include the following:

#### **Sex**

According to the U.S. Department of Education (2000), more women, than men, are enrolled at U.S. colleges and universities. Thus, women subsequently receive more degrees than men. Kinzie et al (2007) has demonstrated that undergraduate females are more actively engaged in “educationally purposeful activities.”

Statistics also show that online students are predominately female (Halsne and Gatta, 2002; and Zirkle, 2003). In regard to online course performance, most researchers (Dille and Mezack, 1991; Lim, 2001; Dutton, Dutton and Perry, 2002; Wojciechowski and Palmer, 2005; Daymont and Blau, 2008; Gerlich, Mills and Sollosy, 2009; and Guidry, 2013) found little to no difference between the sexes. However, Barrett and Lally (1999) and Taplin and Jegede (2001) reported significant performance differences.

#### **Age**

Research investigating the age of students enrolled in web-based courses is mixed. Online education is a better fit for many non-traditional students, likely due to employment and familial responsibilities (Reuter, 2009). However, Buhagar and Potter (2010) found that younger students were more comfortable with web-related technology.

## **Semester load**

Most studies found course load and academic performance to be unrelated for traditional lecture classes (Tinto, 1987; Metzner, 1989; and, Pascarella and Terenzini, 1979). However, Adelman (1992, 2005) concluded that students enrolled for fewer credit hours tended to be more academically successful, while Schultz (2007) demonstrated a weak correlation between course load and success.

Weaver (2005) investigated the performance of online students and found that full time students were more academically successful than part time students. Wojciechowski and Palmer (2005) found no relationship between semester load and the eventual grade earned in an online class.

## **Withdrawals**

Previous research (Frankola, 2001 and Oblender, 2002) has shown that online learners are more likely to drop courses when compared to their face-to-face counterparts, and an inverse relation between number of previous withdrawals and grades in an online class (Wojciechowski and Palmer, 2005).

## **Attempts**

Students taking a particular course for a second (or more) time may have not earned the required grade in the course, or withdrew before being awarded a final grade. In both circumstances, the student will have to take the class again. Some students may want to re-take a class in order to bolster their GPAs. Guidry (2013) found that number of attempts and subsequent grade in an online quantitatively oriented course to be negative, but insignificant.

## **American College Testing (ACT) composite scores, ACT English scores, ACT Math scores, and ACT reading scores**

A study authored by Bettinger, Evans, and Pope (2011) found that English and math ACT scores “are highly predictive of positive college outcomes,” and the reading and science score “have very little predictive ability.” Thus, lumping together these scores with English and math may mar the usefulness of the ACT as a predictor of college success. Gubernick and Eberling (1997) found that online students have higher achievement test scores than those enrolled in lecture classes; and, Guidry (2013) showed that students with higher ACT math scores were more likely to be successful in a quantitatively oriented online course. On the other hand, Freeman (1995) and Mortensen (1995) demonstrated no difference in achievement test scores between online students and lecture students.

## **Student GPA**

Anderson and Benjamin (1994) showed a positive relation between student performance and previous academic efforts. Guidry’s (2013) research demonstrated that students with higher GPAs in the semester prior to enrollment in an online class were more likely to be successful in

the online class. However, Buhagar and Potter (2010) found no significant difference between GPAs of online students and the GPAs of lecture students.

## HYPOTHESIS 2

It is also hypothesized that students enrolled in a numerically based lecture course will not perform any differently than students enrolled in the web version of the same numerically based course. Some studies (Wynegar and Fenster, 2009; and Stephens and Konvalina, 1999) have noted that students enrolled in math-based courses using computer aided instruction did not perform as well as students in lecture courses; Allen et al (2004) found the opposite result.

## MODEL SPECIFICATION AND EMPIRICAL RESULTS

The model for each course (lecture versus web presentation) is written as follows:

$$\text{GRADE}_i = f(\text{SEX}_i, \text{AGE}_i, \text{SEMLD}_i, \text{WDS}_i, \text{ATTS}_i, \text{ACT}_i, \text{ENG}_i, \text{MATH}_i, \text{READ}_i, \text{SMGPA}_i, \text{CMGPA}_i)$$

where:

- $\text{GRADE}_i$  = grade earned by the  $i$ th student (A = 4; B = 3; C = 2; D, F or W = 0).  
 $\text{SEX}_i$  = dummy variable indicating sex of student  $i$  (SEX = 0 if female; 1 if male).  
 $\text{AGE}_i$  = student  $i$ 's chronological age (in years) at time enrolled in course.  
 $\text{SEMLD}_i$  = student  $i$ 's total number of hours carried for the semester during which he/she was enrolled in financial management.  
 $\text{WDS}_i$  = total number of "W"s on student  $i$ 's transcript.  
 $\text{ATTS}_i$  = total number of times student  $i$  has attempted financial management.  
 $\text{ACT}_i$  = student  $i$ 's highest reported composite score on the American College Testing exam (ACT), 0-36.  
 $\text{ENG}_i$  = student  $i$ 's highest reported ACT English score, 0-36.  
 $\text{MATH}_i$  = student  $i$ 's highest reported ACT math score, 0-36.  
 $\text{READ}_i$  = student  $i$ 's highest reported ACT reading score, 0-36.  
 $\text{SMGPA}_i$  = student  $i$ 's semester GPA prior to enrolling in financial management, 0.0-4.0.  
 $\text{CMGPA}_i$  = student  $i$ 's cumulative GPA prior to enrolling in financial management, 0.0-4.0.

The model is also run with the combined data set, including a dummy variable to denote whether the class was the lecture format or the web version (LEC/WEB = 0 if lecture, 1 if class was web version). The results should show whether the final grade earned is dependent upon the method of presentation, lecture versus web presentation.

The university's student database provided the necessary data for this study. Table 1 (Appendix) presents the descriptive statistics of the entire sample, as well as, for each class surveyed. While the mean grade (GRADE) for the lecture class is higher (2.2955 versus 1.3438), the mean age of the students (AGE) and the semester course load (SEMLD) are similar. All of the mean ACT measures (ACT, ENG, READ, and MATH) are higher for the web class, perhaps due to a self-selection bias: academically stronger students may feel more confident in taking a self-directed class without an instructor present. However, the GPA measures (SMGPA and CMGPA) impart the opposite - higher mean semester and cumulative GPAs for those students in the lecture sections.

The empirical results are presented in Table 2 (Appendix). Examination of the significant variables presents only one common predictor of student success – semester GPA prior to enrolling in financial management (SMGPA). The positive relation demonstrates that students with higher semester GPAs earn higher grades in the course surveyed for this study (The cumulative GPA variable, CMGPA, is only significant for the lecture class.) Otherwise, different predictors are significant, dependent upon the class surveyed. In the lecture version, the number of withdrawals (WDS) is inversely related to course performance, while the number of attempts (ATTS) showed a positive relation – those who were familiar with the material in a previous presentation were more likely to earn a better grade. Results for the web class confirm the results of other studies: students with higher ACT math scores (MATH) are more likely to be academically successful in a numerically based course (Allen and Sconing, 2005; and Guidry, 2013). The combined data set had no significant variables, except for that which distinguished between the two methods of presentation (LEC/WEB). The result seems to validate the findings of Wynegar and Fenster (2009) and Stephens and Konvalina (1999): students in online versions do not perform as well as those enrolled in the lecture class of mathematical material.

## CONCLUSION

While the introduction of computer aided technology is a powerful tool to teach college level subjects, including quantitatively oriented material, most students prefer a face-to-face presentation of mathematics. Many studies have found no difference in the success of online students versus those enrolled in the lecture version of the same class. However, few, if any, have tried to examine whether the predictors of student performance were the same for a mathematically oriented course, regardless of the method of presentation. It is the purpose of this study to examine whether the student performance predictors in a numerically based lecture course are similar to those for the web version of the same course, as well as, to determine if there is a difference in the performance of such students. Examination of the significant variables presents only one common predictor of student success – semester GPA prior to enrolling in the course is positively related to the grade earned in the class. Students with higher semester GPAs earn higher grades in the quantitative course. Otherwise, different predictors are significant, dependent upon the class surveyed. In the lecture version of the class, the total number of previous course withdrawals is inversely related to course performance, while the total number of previous attempts at the course surveyed showed a positive relation – those who were familiar with the material in a previous presentation were more likely to earn a better grade. For the online students, those with higher ACT math scores are more likely to earn higher grades in financial management, the class surveyed. Furthermore, students in the online version of financial management did not perform as well as those enrolled in the lecture class.



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